(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 730 134 B1

(12) EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:
03.01.2001 Bulletin 2001/01

(51) Int Cl.[7]: **F28F 3/08**, F28D 9/00, F28F 9/04

(21) Application number: **96107859.9**

(22) Date of filing: **27.09.1991**

(54) Layer-built heat exchanger

Wärmetauscher mit gestapelten Platten

Echangeur de chaleur à plaques empilées

(84) Designated Contracting States:
DE FR GB IT SE

(30) Priority: **28.09.1990 JP 26099290**
26.10.1990 JP 28872590
05.04.1991 JP 7287191

(43) Date of publication of application:
04.09.1996 Bulletin 1996/36

(62) Document number(s) of the earlier application(s) in accordance with Art. 76 EPC:
91916786.6 / 0 503 080

(73) Proprietor: **MATSUSHITA REFRIGERATION COMPANY**
Higashiosaka-shi, Osaka 577 (JP)

(72) Inventors:
- **Matsunaga, Tsuyoshi**
  Yasugun, Shiga 520-23 (JP)
- **Fujino, Kenji**
  Nara-shi, Nara 630 (JP)
- **Sugahara, Takashi**
  Otsu-shi, Shiga 520-21 (JP)
- **Kan, Hiroaki**
  Otsu-shi, Shiga 520-22 (JP)

(74) Representative: **Eisenführ, Speiser & Partner**
Martinistrasse 24
28195 Bremen (DE)

(56) References cited:
DE-C- 229 510
FR-A- 1 345 756
GB-A- 788 185

- **PATENT ABSTRACTS OF JAPAN vol. 015, no. 222 (M-1121), 6 June 1991 & JP 03 063496 A (MATSUSHITA REFRIG CO LTD), 19 March 1991,**
- **PATENT ABSTRACTS OF JAPAN vol. 013, no. 189 (M-821), 8 May 1989 & JP 01 014595 A (MATSUSHITA REFRIG CO), 18 January 1989,**
- **PATENT ABSTRACTS OF JAPAN vol. 014, no. 198 (M-0965), 23 April 1990 & JP 02 040496 A (MATSUSHITA REFRIG CO LTD), 9 February 1990,**

EP 0 730 134 B1

Description

[0001] The present invention relates to a layer-built heat exchanger comprising: a first-side plate having plural channels for coolant flow formed by dividers on a flat rectangular panel, a hole at one end of the channels, and a hole on a diagonal line to the first hole on a different side of the plate; a second-side plate having plural channels for coolant flow formed by dividers on a flat rectangular panel, a hole formed separately at one end of the channels continuously to the corresponding hole in the first-side plate, and a hole on a diagonal line to the first hole on a different side of the plate continuously to the corresponding hole in the first-side plate; a seal plate between the first-side plate and the second-side plate; an end plate provided on both ends; and inlet/outlet pipes for the first and second coolants provided on one of the end plates continuous to said holes.

[0002] Such a heat exchanger is known from JP-A-03 063 496.

[0003] The present invention is particularly used in a radiator for coolant oil in machine tools or in an air conditioner.

[0004] Demand has risen for layer-built heat exchangers capable of using chlorofluorocarbons (CFC) and water and oil coolants in combination as first and second coolants for exchanging heat between CFC and CFC, CFC and water, water and water, or oil and water. A conventional layer-built heat exchanger is described below with reference to Figs. 1 - 5 (Japanese Patent Laid-Open No. 61-243297).

[0005] As shown in the figures, the conventional layer-built heat exchanger 1 combines plural first-side plates 2, seal plates 3, and second-side plates 4 between end plates 5a and 5b. The inlet pipes 6, 8 and outlet pipes 7, 9 for the first and second coolants, respectively, are connected to the one end plate 5b.

[0006] The first-side plate 2 has a rectangular shape with a pair of round holes 10, provided offset from the center at each end of the plate, for the first coolant flow. A series of parallel and winding channels 11 are formed by dividers 12 for conducting the coolant from a position near the round hole 10 at one end of the first-side plate 2 to a position near the round hole 10 at the other end.

[0007] Holes 13 for the flow of the second coolant are also formed on a diagonal line on the first-side plate 2 on the sides different from those on which the round holes 10 are formed. Each hole 13 has a rectangular shaped area 14 and a semi-circular shaped area 15 at the middle of the long side of the rectangular shaped area 14.

[0008] The second-side plate 4 has a similar rectangular shape with a series of parallel and winding channels 16 formed by dividers 17 to conduct the coolant between the two round holes 18. These round holes 18 are formed correspondingly to the holes 13 in the first-side plate 2 with part of each hole 18 tracing the same arc as the semi-circular shaped area 15 of the corresponding hole 13 in the first-side plate 2. Holes 19 are also provided correspondingly to the round holes 10 in the first-side plate 2. Each hole 19 also consists of a rectangular shaped area 20 and a semi-circular shaped area 21 at the middle of the long side of the rectangular shaped area 20 such that part of each semi-circular shaped area 21 traces the same arc as the corresponding round hole 10 in the first-side plate 2.

[0009] The seal plate 3 has holes 22 and 23 similarly shaped to the corresponding holes 13 and 19 in the first- and second-side plates 2 and 4, respectively. The length of the rectangular shaped area 14 and 20 of the holes 13 and 19 is made long enough to cover the ends of each of the channels 11 and 16, respectively.

[0010] The plates are then assembled in successive layers in the order of first-side plate 2, seal plate 3, second-side plate 4, seal plate 3, first-side plate 2, seal plate 3, ... as shown in Fig. 5, and are sealed between the seal end plate 5a on one end and the end plate 5b provided with the first and second coolant inlet pipes 6, 8 and outlet pipes 7, 9.

[0011] With this construction the first coolant flows in through the inlet pipe 6, is diffused to the channels 11 of the first-side plate 2 in the rectangular shaped area of the hole 22 in the seal plate 3, and flows through the channels 11 to the hole 22 on the opposite side to flow out from the outlet pipe 7. Similarly, the second coolant flows in through the inlet pipe 8, is diffused to the channels 16 of the second-side plate 4 in the rectangular shaped area of the hole 23 in the seal plate 3, and flows out through the hole 23 on the opposite side to the outlet pipe 8.

[0012] Heat is exchanged between the first and second coolants through the seal plate 3, which is made from a material with good thermal conductivity for greater heat exchange efficiency.

[0013] In the cause of assembling the inlet/outlet pipes 6, 7, 8 and 9 to the end plate 5b, the holes in the end plate 5b must be countersunk so that the inlet/outlet pipes 6, 7, 8 and 9 can be positioned.

[0014] It is an object of the present invention to provide a layer-built heat exchanger in which the positioning of the inlet/outlet pipes to the end plate is simplified.

[0015] In accordance with the invention, a layer-built heat exchanger as defined in the preamble of the claim is characterized in that the inlet/outlet pipes are inserted through the one end plate to the end plate on the other side, and that a elongated slit hole is provided in the inlet/outlet pipes through the length of the layer of the first-side plates, second-side plates and seal plates at the position corresponding to the holes in the plates.

[0016] The invention will now be described in connection with the drawings.

Fig. 1 is an oblique view of a conventional layer-built heat exchanger,

Fig. 2 is a plan view of the first-side plate in Fig. 1,

Fig. 3 is a plan view of the seal plate in Fig. 1,

Fig. 4 is a plan view of the second-side plate in Fig. 1,

Fig. 5 is a cross sectional view of line V-V in Fig. 1, and

Fig. 6 is a cross sectional view of a layer-built heat exchanger according to an embodiment of the present invention.

[0017] An embodiment of the invention is described below with reference to Fig. 6. Like parts in the preferred embodiment and the prior art described above are referred to by like reference numbers, and further description of said like parts is omitted hereinbelow.

[0018] In this embodiment the inlet pipe 6 for the first coolant passes through the end plate 5b, the round holes 10 in the first-side plates 2, the holes 22 in the seal plates 3, and the holes 19 in the second-side plates 4 to the other end plate 5a. An elongated slit hole 62 is formed in the inlet pipe 6 at the position corresponding to the holes 10, 22, and 19. The outlet pipe for the first coolant and the inlet/outlet pipes for the second coolant are similarly formed through each of the plates to the end plate 5a.

[0019] It is thus possible during assembly to simply insert the inlet/outlet pipes through the holes to the opposite end plate to simply and correctly position the inlet/outlet pipes in the layer-built heat exchanger.

Claims

1. A layer-built heat exchanger comprising: a first-side plate (2) having plural channels (11) for coolant flow formed by dividers (12) on a flat rectangular panel, a hole (10) at one end of the channels, and a hole (13) on a diagonal line to the first hole on a different side of the plate; a second-side plate (4) having plural channels (16) for coolant flow formed by dividers (17) on a flat rectangular panel, a hole (18) formed separately at one end of the channels continuously to the corresponding hole in the first-side plate, and a hole (19) on a diagonal line to the first hole on a different side of the plate continuously to the corresponding hole in the first-side plate; a seal plate (3) between the first-side plate (2) and the second-side plate (4); an end plate (5a, 5b) provided on both ends; and inlet/outlet pipes (6, 7, 8, 9) for the first and second coolants provided on one of the end plates continuous to said holes
characterized in that
the inlet/outlet pipes (6, 7, 8, 9) are inserted through the one end plate (56) to the end plate (5a) on the other side and that an elongated slit hole (62) is provided in the inlet/outlet pipes (6, 7, 8, 9) through the length of the layer of the first-side plate, second-side plates, and seal plates at the position corresponding to the holes in the plates.

Patentansprüche

1. Mehrschichten-Wärmetauscher

mit einer ersten flachen, rechteckigen Platte (2), die zwischen Trennstegen (12) eine Mehrzahl von Kanälen (11) für den Durchfluss von Kühlmittel, eine erste Öffnung (10) an einem Ende der Kanäle und eine weitere Öffnung (13) auf einer Diagonallinie zur ersten Öffnung auf einer anderen Seite der Platte aufweist;
mit einer zweiten flachen, rechteckigen Platte (4), die zwischen Trennstegen (17) eine Mehrzahl vn Kanälen (16) für den Durchfluss von Kühlmittel, eine an einem Ende der Kanäle und an die entsprechende Öffnung der ersten Platte anschließend getrennt angeordnete erste Öffnung (18) sowie eine weitere Öffnung (19) auf einer Diagonallinie zur ersten Öffnung auf einer anderen Seite der Platte an die entsprechende Öffnung der ersten Platte anschließend aufweist;
mit einer Abdichtungsplatte (3) zwischen der ersten Platte (2) und der zweiten Platte (4);
mit einer Endplatte (5a, 5b) an den beiden Enden; und
mit Einlass/Auslassrohren (6, 7, 8, 9) an einer der Endplatten an die Öffnungen anschließend für die ersten und zweiten Kühlmittel;

dadurch gekennzeichnet, dass
die Einlass/Auslassrohre (6, 7, 8, 9) durch die eine Endplatte (5b) hindurch in die Endplatte (5a) auf der anderen Seite eingesetzt sind, und
dass die Einlass/Auslassrohre (6, 7, 8, 9) eine längliche Schlitzöffnung (62) über die Länge der Schichten aus ersten Platten, zweiten Platten und Abdichtungsplatten im Bereich der Öffnungen in den Platten aufweisen.

Revendications

1. Echangeur de chaleur à structure stratifiée comprenant : une plaque de premier côté (2) comportant plusieurs canaux (11) destinés à une circulation d'agent de refroidissement, formés par des séparateurs (12) sur un panneau rectangulaire plat, un trou (10) à une extrémité des canaux, et un trou (13) sur une ligne diagonale par rapport au premier trou sur un côté différent de la plaque, une plaque de second côté (4) comportant plusieurs canaux (16) destinés à une circulation d'agent de refroidissement, formés par des séparateurs (17) sur un panneau rectangulaire plat, un trou (18) formé de façon séparée à une extrémité des canaux, en continuité du trou correspondant dans la plaque de premier côté, et un trou (19) sur une ligne diagonale

par rapport au premier trou sur un côté différent de la plaque en continuité du trou correspondant dans la plaque de premier côté, une plaque d'étanchéité (3) entre la plaque de premier côté (2) et la plaque de second côté (4), et une plaque d'extrémité (5a, 5b) disposée aux deux extrémités, et des tubes d'entrée/sortie (6, 7, 8, 9) destinés aux premier et second agents de refroidissement, disposés sur l'une des plaques d'extrémité en continuité desdits trous

caractérisé en ce que

les tubes d'entrée/sortie (6, 7, 8, 9) sont insérés au travers de la plaque de première d'extrémité (5b) vers la plaque d'extrémité (5a) de l'autre côté et en ce qu'un trou allongé en forme de fente (62) est réalisé dans les tubes d'entrée/sortie (6, 7, 8, 9) suivant la longueur de la couche des plaques de premier côté, plaques de second côté, et plaques d'étanchéité, à la position correspondant aux trous dans les plaques.

FIG. 1

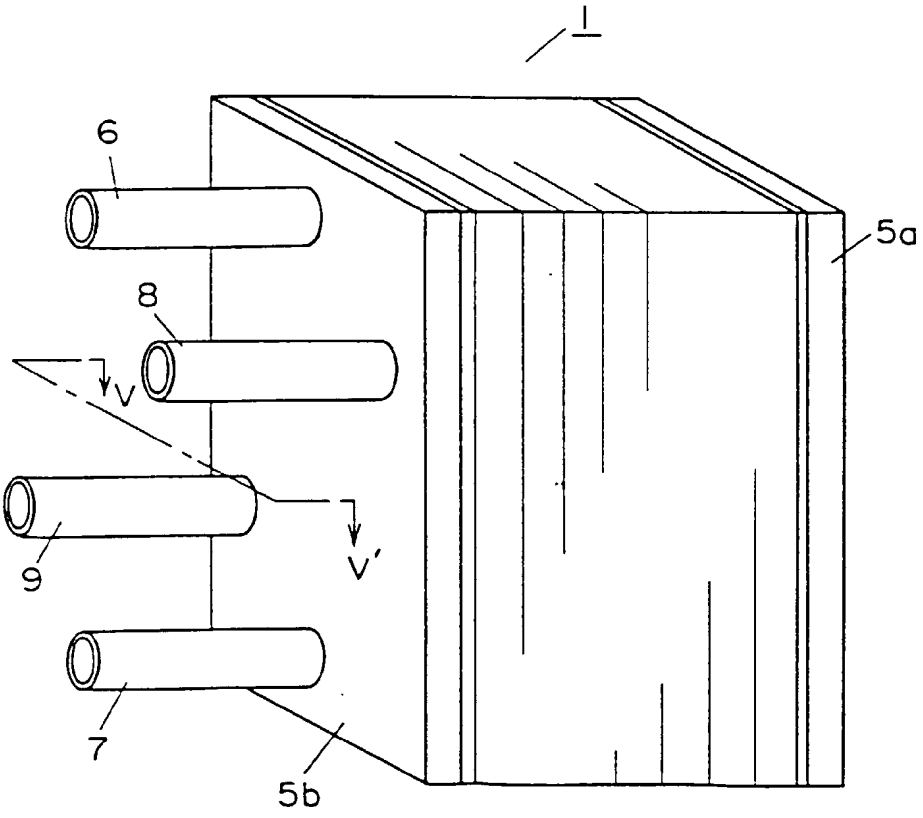

FIG. 4

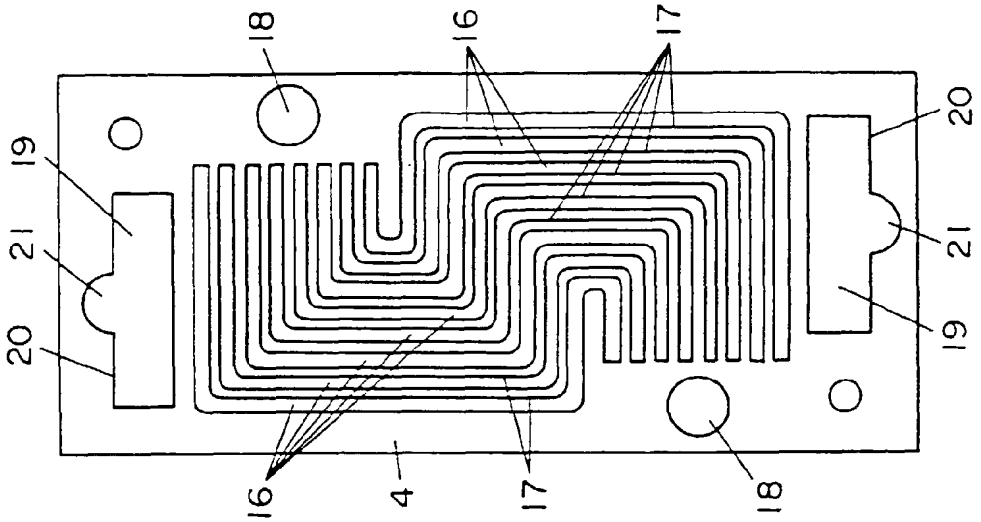

FIG. 3

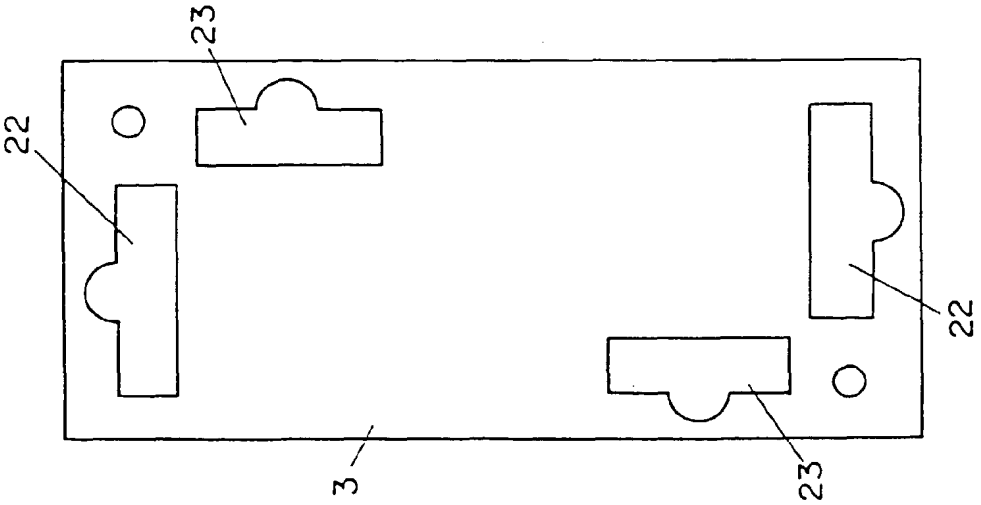

FIG. 2

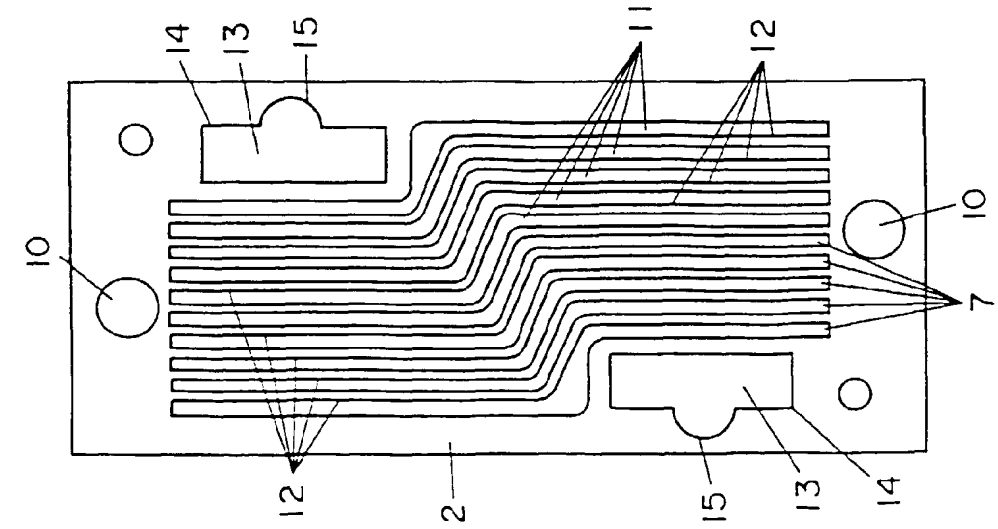

FIG. 5

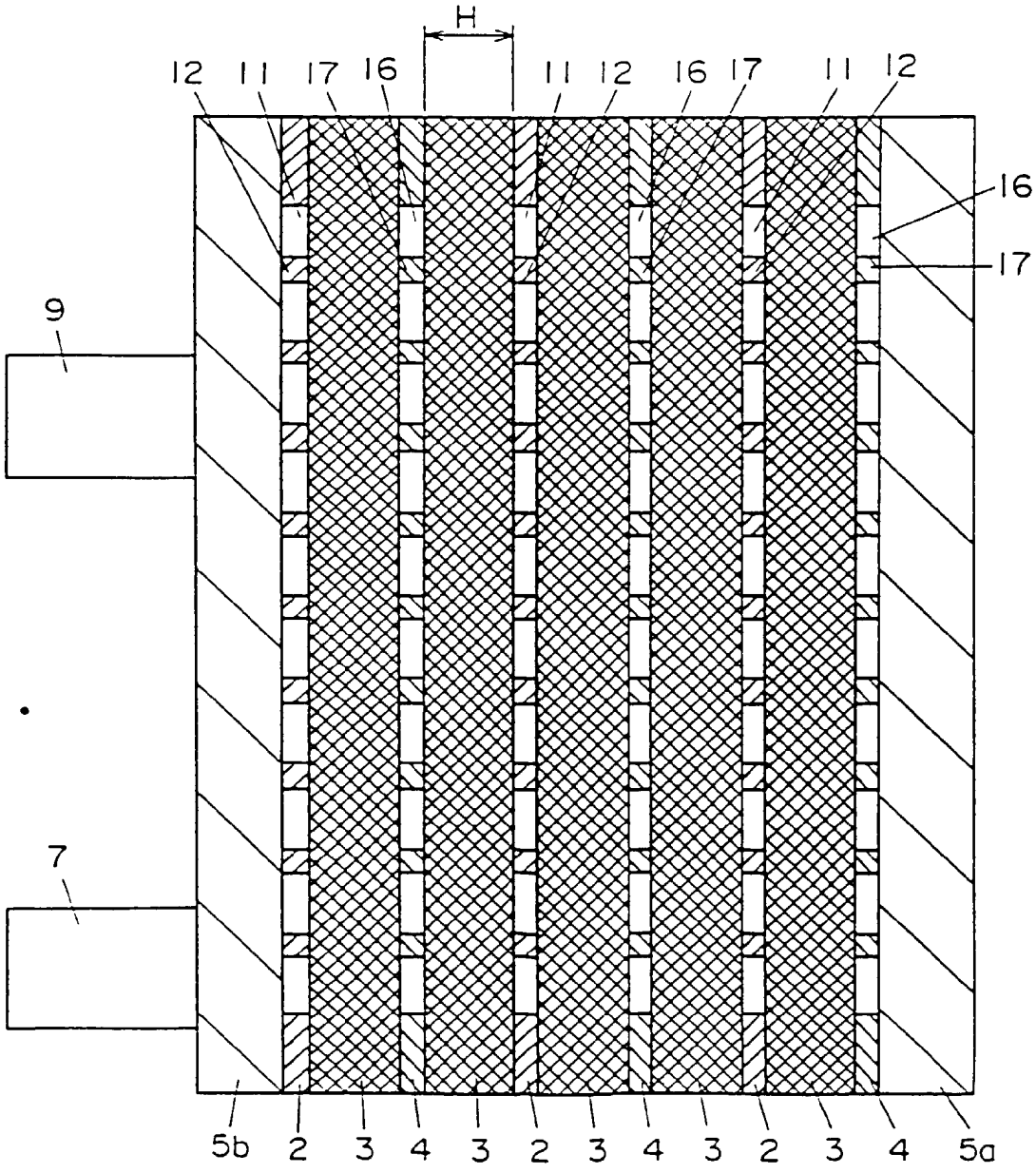

FIG. 6